REMARKS

This paper is responsive to the Office Action mailed March 7, 2006. All of the rejections are respectfully traversed. Reexamination and reconsideration of the application are respectfully requested.

The Office Action

In the Office Action mailed March 7, 2006:

claims 4-6, **10-15** and **19-23** were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,418,895 to Lee ("Lee") in view of U.S. Patent No. 5,726,781 to Isemura, et al. ("Isemura"); and

claims 7-9 and **16-18** were rejected under 35 U.S.C. §103(a) as being unpatentable over Lee and Isemura and further in view of U.S. Patent No. 5,612,792 to Ichikawa, et al. ("Ichikawa").

The Present Application

By way of brief review, **the subject application is related to rendering black and white versions of color images**. The problem addressed is that to render black and white versions of color images, millions of colors must be mapable to, for example, 256 shades of gray available from a typical black and white rendering device or printer.

One way to map color pixels to black and white gray levels is to determine a luminance or lightness level associated with the color of the pixel and to render the black and white version of the pixel according to the luminance. However, this means that many different colors will be mapped to the same gray level. This is generally not a problem when the image to be rendered in black and white is a photograph. However, when the image is a business graphic, such as a map, bar chart or pie chart, having, for example, a key or legend defining elements according to colors, if a red bar and a green bar in a bar graph happen to have the same luminance, a black and white version of the graph mapped to black and white strictly according to luminance can be rendered useless because the red bar and the green bar will be rendered with the same shade of gray and the legend can no longer be used to identify which bar is which.

As explained in the present application, beginning on page 2 at line 13 and

continuing on through page 3 - line 9, attempts have been made to alleviate this problem by using texturing to increase the number of ways colors can be represented in a black and white image. Typically, under these strategies, the conversion to black and white is accomplished by dividing a color space into a finite number of bins and assigning a different halftone pattern to each of the bins. This approach does preserve more information from the color image. **However, this approach can lead to abrupt transitions in the black and white image, which may not be desired in some applications**. In this regard, where colors in the original image smoothly blend from one color to another, the blend in color can cross a bin boundary, resulting in a sudden shift in a halftone pattern or level. This situation can be further aggravated by the presence of noise in the image. For example, a subtle jitter or shift in the color in a photograph of a persons face can be transformed into dramatic changes in halftone patterns if the jitter or shift is across one or more bin boundaries.

All halftoning methods by definition introduce some distortion in the output image. Designers of halftoning methods typically make tradeoffs in representing the visual parameters of spatial detail versus tonal fidelity. The additional requirement to represent color statically in the halftone pattern reduces the capability of the halftoning system to represent the two visual parameters. For this reason, where these techniques are used, they are generally **not** available in "walk up mode". Therefore, prior art image processors often have controls for various modes of operation which set tradeoffs between the visual parameters and the addition texture related features. The use of these controls puts an additional cognitive load on the "walk up" or casual users. The user must know the features are available and know how to use them. Thus, it is a great advantage if the image processor can make intelligent choices on when and where to make the tradeoff of color representation.

The solution provided by the present application is to analyze an input color image to look for colors that have the same luminance (or other parameter used to map the colors to black and white gray levels), **classify** such colors as "**conflicting**" and apply special processing to at least some of the conflicting colors. For simplicity, the rest of this discussion will refer to luminance. However, it should be understood that some other characteristic can be substituted for luminance.

As indicated above, the present application refers to colors having the same or similar luminance (such that they would be rendered with the same black and white gray level) as **conflicting colors**. When a pair of conflicting colors is found in an image, a texture or modulation is applied to the black and white version of at least one of them. For example, please compare FIG. 2 and FIG. 10 from the present application. Without the reference numerals, it is respectfully submitted that the viewer could not tell which wedge is meant to refer to notions and which wedge is meant to refer to meat in FIG. 2. However, those wedges are clearly identified in FIG. 10.

An advantage of the methods disclosed in the present application is that since texturing is added to only black and white versions of some of the conflicting colors, **distortions to images are minimized**. This allows the process to be implemented in a default or "walkup mode" in a copier, because even if a copied image is a color photograph, only conflicting colors will be affected and will probably to unnoticed.

The Newly Cited References

In stark contrast, the primary reference of the Office Action to **Lee is completely unconcerned with rendering black and white versions of color images**. Instead, Lee is concerned with a method for displaying a high-quality digital **color image** on a limited **color display**. In this regard, it is respectfully submitted that Lee is non-analogous art with respect to the claims of the present application.

Furthermore, even if Lee is considered analogous art, since Lee is not concerned with rendering black and white versions of color images, Lee cannot and does not disclose or suggest looking for colors that have the same luminance (or other parameter used to map the colors to black and white gray levels) and classifying such colors as "conflicting" or applying special processing to at least some of such identified or classified conflicting colors. In support of the assertion that Lee discloses classifying peaks within a histogram that have similar luminance as conflicting colors, the Office Action directs the attention of the Applicant to column 6, lines 8-18. However, the cited portion of column 6 only discusses a method for calculating a particular kind of color distance and is **unrelated to**

classifying peaks having the same luminance as conflicting colors. Instead, the cited portion of column 6 is related to a method for "clustering" colors. In the discussed clustering technique, a color histogram is partitioned into separate volumes (one for each peak) such that each point c in the volume has a shorter distance to the peak m in that volume than to any other peaks (column 5, lines 48-54).

It is respectfully submitted that the secondary references to Isemura and Ichikawa do not cure the deficiencies of Lee.

Isemura allegedly discloses a number of methods for converting color images to monochrome pattern images. However, it is respectfully submitted that none of the methods of Isemura disclose or suggest classifying colors in an image having similar luminance as conflicting colors or applying a texture pattern or modulation to only single color inversions of at least one of the conflicting colors. As such, the methods of Isemura are not provided in a **"walk-up mode."** Instead, because the techniques of Isemura are not appropriately applied to all images, a color recognition image editing mode must be selected by a system user (e.g., column 17, lines 26-27; FIG. 34, S113; column 18, lines 4-6; FIG. 37, S123). If the color recognition image editing mode is not selected, then ordinary or "walk-up mode" procedures are executed (e.g., FIG. 34, S119; FIG. 37, S129). Additionally, like the prior art image processors discussed, for example, at page 2, line 31 - page 3, line 4, the system of Isemura has controls (e.g., FIG. 5 and FIG. 7) for various modes of operation which set tradeoffs between visual parameters and the added texture-related features. The use of these controls puts an additional cognitive load on the "walk-up" or casual user (e.g., FIG. 9A, 9B, 10A, 10B). The user must know the features are available and know how to use them.

In contrast, the image processor of the present application can make intelligent choices about when and where to add texture, patterns or spatial modulation. Additionally, the assertions of the Office Action notwithstanding, Isemura does not disclose or suggest applying at least one distinct spatial modulation to, and only to, at least one representative single colorant version of at least on of the **conflicting colors**. Instead, as depicted in FIG. 9A, Isemura discloses assigning one pattern to an entire range (the slice approximating about 20 percent of the available color space) of colors (e.g., FIG. 9A(d)). Furthermore,

Isemura does not disclose or suggest ensuring that all single colorant versions of colors in the image are visual distinguishable from one another while minimizing distortions in a remainder of the single colorant version of the image. In this regard, the Office Action cites column 10, lines 5-11. However, the cited portion describes actions of a character pattern generator which adds color names to an image thereby distorting the image by including text in the monochrome copy that was not included in the color original (column 10, lines 38-51). It is respectfully submitted that such a technique would not be appropriate for walk-up mode because, for example, if a color photograph were included in the color image being copied, the resultant output image would be completely covered with text identifying colors of various portions of the photograph.

Additionally, it is respectfully submitted that there is no motivation in the art for combining subject matter from Isemura into the subject matter of Lee. It is also respectfully submitted that the sentence alleging a motivation for combining some aspects of the disclosure of Lee and Isemura is unclear, specious and/or based on impermissible hindsight reasoning. The last portion of the sentence --to allow for accurate recognition of color in images of original images in full representation when the image is produced in a monochromatic output device, such as a printer, copier or the like-- appears to be a recitation of aspects of Isemura on its own and does not require the inclusion of any aspect of Lee. Furthermore, even if Lee included the subject matter for which it is relied, motivation to combine that subject matter with Isemura would only be found in the present application. Clarification of the assertions of obviousness is respectfully requested.

Ichikawa allegedly discloses an image processing method and apparatus for outputting a pattern image in accordance with the color and density level of each color of the output polychromatic image. The method includes the steps of discriminating the color type of an input color image from an input color image signal, generating a pattern signal indicating a predetermined graphic pattern corresponding to the color type in response to the color discrimination, generating a density signal in accord with the input color image signal, and supplying a reproduction signal in accord with the pattern signal and the density signal to an image reproduction unit (Abstract).

However, Ichikawa does not disclose or suggest analyzing an input color

image to look for colors that have the same luminance (or other parameter used to map the colors to black and white gray levels) and **classifying** such colors as **"conflicting"** and applying special processing **only to** at least some of the **conflicting colors**.

Isemura appears to discuss techniques similar to the techniques described in the background section of the present application (for example, at page 2, lines 16-25) in that the technique of Isemura can lead to abrupt transitions in the black and white image. For example, even though FIG. 21A of Isemura, which represents an input image having a W red part, X green part, Y blue part and Z gray part wherein their lower portions become **gradually lighter** than their upper portions, is rendered by the methods of Isemura as shown in FIG. 20B, which appears to include abrupt transitions from, for example, thick stripes to high-frequency thin stripes to lower-frequency thin stripes as depicted in bars W and X of FIG. 20B (column 14, lines 47-55).

The Office Action asserts that Ichikawa discloses measuring a color distance between at least one pixel in the image and at least one conflicting color and directs the attention of the Applicant to column 13, lines 32-65 and FIG. 20A in support of this assertion.

However, FIG. 20A of Ichikawa depicts an input image or "original subject" in an example (column 4, lines 44-45; column 14, lines 47-50) and does not disclose or suggest measuring a color distance between a pixel and at least one conflicting color. Additionally, it is respectfully submitted that the cited portion of column 13 is unrelated to measuring a color distance between at least one pixel in the image and at least one **conflicting color**. Instead, the cited portion of column 13 appears to be related to assigning patterns to ranges of color densities (e.g., see column 13, lines 45-52) and the related portions of, for example, the abruptly changing patterns of FIG. 20B in, for example, the bar labeled W.

For at least the foregoing reasons, it is respectfully submitted that Ichikawa does not disclose or suggest the subject matter for which it is relied.

Additionally, even if Ichikawa is considered to include the subject matter for which it is relied, there is no motivation in the art to combine elements of Ichikawa with Lee and Isemura other than that found in the present application. For example, the motivation asserted by the Office Action "to allow for further distinguish between

images having the same color but different density levels, to represent a full color image with different patterns, because colors are known in the art to have various densities" did not occur to **Isemura** or to Lee which were filed after Ichikawa, and Isemura appears to have been a **co-inventor** in Ichikawa.

Reconsideration of the Restriction Requirement

In the middle paragraph on page 3 of the Detailed Office Action, there is an explanation that the Examiner interprets the graphic monochrome patterns of Isemura as spatial modulation. If the graphic monochrome patterns of Isemura are fairly interpreted as spatial modulation, it is respectfully submitted that the -- selectively adding texture-- recited in withdrawn claim 1 is also fairly interpreted as spatial modulation and withdrawal of the restriction requirement is respectfully requested.

The Claims are not Obvious

Claims 4-6, **10-15** and **19-23** were rejected under 35 U.S.C. §103(a) as being unpatentable over Lee in view of Isemura.

However, in explaining the rejection of **claim 4**, the Office Action asserts that Lee discloses classifying peaks within a histogram that have similar luminance as conflicting colors. In this regard, the Office Action directs the attention of the Applicant to column 6, lines 8-18. As explained above, it is respectfully submitted that the cited portion of column 6 describes a particular kind of color distance calculation relative to a clustering process (column 5, lines 48-57) and is unrelated to classifying peaks within a histogram that have similar luminance as **conflicting colors**. It is respectfully submitted that Lee includes no reference to conflicting colors or any phrase that can be fairly interpreted as being analogous to conflicting colors as described in the present application.

For at least the foregoing reasons, **claim 4**, as well as **claims 5-9**, which depend therefrom, is not obvious in light of Lee and Isemura taken alone or in any combination.

Additionally, Lee is not concerned with rendering single colorant or black and white versions of color images. In this regard, Lee is non-analogous art with respect to the claims of the present application. Indeed, the Office Action stipulates that Lee

fails to disclose many elements recited in **claim 4** including rendering a color image into a single colorant color space and applying at least one distinct spatial modulation to, and only to, at least one representative single colorant version of at least one of the conflicting colors.

The Office Action relies on Isemura for disclosure of the stipulated deficiencies of Lee. However, Isemura does not disclose or suggest applying spatial modulation to, and only to, single colorant versions of conflicting colors. Isemura does not disclose or suggest or acknowledge a method that applies graphic monochrome patterns or spatial modulations only to conflicting colors. Instead, it is respectfully submitted that Isemura appears to advocate or suggest applying the same pattern to large portions of a color space or gamut of an image (FIG. 9A(e), FIG. 9B(a)(b), FIG. 10B(a)(b) and FIG. 44). Isemura does not disclose or suggest applying graphic monochrome patterns or spatial modulations only in a limited way, thereby ensuring that all single colorant versions of colors in the image are visually distinguishable from one another while minimizing distortions in a remainder of the single colorant version of the image. As if to emphasize this point, Isemura acknowledges that a system user should have to specifically request the processing of Isemura (e.g., FIG. 5; FIG. 7; **FIG. 6B, S4, S5**; **FIG. 8B, S4, S5**; FIG. 9A; FIG. 9B; FIG. 10A; FIG. 10B; **FIG. 34, S113**; **FIG. 37, S123**).

For at least the foregoing additional reasons, **claim 4**, as well as **claims 5-9**, which depend therefrom, is not anticipated and is not obvious in light of Lee and Isemura taken alone or in any combination.

Additionally, there is no motivation in the art, other than that provided by the present application, to combine the cited portions of Lee and Isemura. The motivation asserted by the Office Action "to allow for accurate recognition of color in images of original images in full representation when the image is reproduced in a monochrome output device" is something allegedly achieved by Isemura. Therefore, there is no motivation to combine the color clustering of Lee into the subject matter of Isemura or to combine the entire disclosure of Isemura into the subject matter of Lee. If there were any motivation to combine Lee and Isemura, it could only be found in the present application, and the rejection of **claim 4** is, therefore, based on impermissible hindsight.

For at least the foregoing additional reasons, **claim 4**, as well as **claims 5-9**,

which depend therefrom, is not anticipated and is not obvious in light of Lee and Isemura taken alone or in any combination.

In explaining the rejection of **claim 5**, the Office Action indicates that the Examiner interprets clustering as classifying. It is respectfully submitted that merely clustering is not fairly interpreted as classifying. Moreover, the claims of the present application recite classifying as conflicting colors. Even if the clustering of Lee could be fairly interpreted as classifying, Lee does not disclose or suggest classifying the identified peaks of Lee as **conflicting colors**. Indeed, Lee does not even disclose or suggest considering the luminance associated with the peaks or comparing the luminance of the peaks.

Regarding **claim 6**, the Office Action asserts that Isemura discloses applying spatial modulation further comprises associating a unique modulation to the single colorant versions of each of the conflicting colors and directs the attention of the Applicant to FIG. 42. However, FIG. 42 of Isemura is a plan view of an operation unit (column 4, line 4) **and does not disclose or suggest associating a unique modulation to single colorant versions of conflicting colors**. As explained above, it is respectfully submitted that Isemura does not disclose or suggest applying patterns only to conflicting colors. Indeed, in each of the examples of Isemura, **Isemura applies a pattern for all of the colors in the example images**.

For at least the foregoing additional reason, **claim 6** is not anticipated and is not obvious in light of Lee and Isemura taken alone or in any combination.

In explaining the rejection of independent **claim 10**, the Office Action asserts that Lee discloses an image analyzer operative to find and classify conflicting colors in the color image and directs the attention of the Applicant to column 5, lines 26-57, in support of the assertion. However, while the cited portion of Lee discusses using a histogram, Lee does not disclose or suggest using a histogram in order to classify **conflicting colors** in the image. Instead, Lee discloses a histogram in order cluster colors about a representative peak. That is, the entire color histogram of Lee is partitioned into separate volumes (one for each peak) such that each point c in a volume has a shorter distance to the peak m in that volume than to any other peaks (column 5, lines 50-54). Lee does not disclose or suggest that the peaks are associated with conflicting colors or compare the luminosity or any other aspect of the peaks. Further in this regard, arguments similar to those submitted regarding

claims 1 and **5** are submitted in support of **claim 10**.

Additionally, the Office Action stipulates that Lee fails to disclose an image processor operative to generate a single colorant version of a color image or a gray scale modulator operative to add spatial modulations to single colorant versions of **only the conflicting colors** within the single colorant version of the color image.

Instead, the Office Action asserts that Isemura discloses these elements. However, as explained above, Isemura does not disclose or suggest adding spatial modulations to single colorant versions of only the conflicting colors. FIG. 42, referenced by the Office Action, is a plan view of an operation unit and does not disclose or suggest conflicting colors. Column 19, line 59 - column 20, line 3, points out that an operator must enter a color detection patterning mode and, therefore, differentiates the subject matter of Isemura from the subject matter of the present application, which can be included in a "walk-up mode" of an image processor or copying machine.

The remainder of the cited portion describes a scanning process whereby a CCD image sensor reads color information of an original and wherein signals from the CCD image sensor are converted into digital signals by A/D converters. Isemura explains that a luminance signal Y is generated from the digital signals in the cited portion of column 20. However, nothing in the cited portions of Isemura discloses or suggests **identifying conflicting colors** or adding spatial modulations to single colorant versions of **only the conflicting colors**.

For at least the foregoing reasons, **claim 10**, as well as **claims 11-20**, which depend therefrom, is not anticipated and is not obvious in light of Lee and Isemura taken alone or in any combination. Additionally, there is no motivation in the art to combine the cited portions of Lee and Isemura. In this regard, arguments similar to those submitted with regard to motivation to combine presented in reference to **claim 1** are submitted in support of **claim 10**.

For at least the foregoing additional reasons, **claim 10**, as well as **claims 11-20**, which depend therefrom, is not anticipated and is not obvious in light of Lee and Isemura taken alone or in any combination.

With regard to **claim 11**, the Office Action directs the attention of the Applicant to column 5, lines 50-57. However, the cited portion of Lee indicates that --the entire color histogram is then partitioned into separate volumes (one for each

peak) such that each point c in a volume has a shorter distance to the peak m in that volume than to any other peaks. Each peak in the input color image is then labeled, according to the volume that contains its color--. Lee is not concerned with generating single colorant versions. Therefore, contrary to the assertion of the Office Action, Lee does not disclose or suggest a histogram collector operative to classify pixels in the color image based on a characteristic that is also used to generate a single colorant version. The histogram of Lee is simply used to cluster colors about peaks.

With regard to claim 12, the Office Action asserts that Lee discloses a conflicting color detector operative to examine the histogram and find pixels that are similar with respect to the characteristic that is used to generate the single colorant version. However, Lee does not disclose or suggest generating a single colorant version. Therefore, Lee cannot disclose or suggest finding pixels that are similar with respect to a characteristic that is used to generate a single colorant version.

With regard to claim 13, the Office Action asserts that Lee discloses a color relationship discriminator operative to receive conflicting color classification information. However, Lee is silent with regard to conflicting colors. Column 5, lines 21-34 (cited by the Office Action), indicate that luminance is dominated by a variation of surface orientation and illumination gradiant and can, therefore, be discounted by giving it a smaller waiting factor when computing color differences between two pixels (column 5, lines 21-24). The remainder of the cited portion describes the size or dimensions of a three-dimensional histogram to be used for clustering and is completely unrelated to conflicting color classification information.

Regarding claim 14, the Office Action directs the attention of the Applicant to column 17, lines 37-47, of Isemura and asserts that Isemura discloses a spatial modulation attenuator operative to attenuate a gray scale modulation based on the relationship between the color image pixel and the conflicting color. However, as explained above, Isemura does not disclose or suggest identifying conflicting colors or processing based on the identification of conflicting colors. Moreover, column 17, lines 37-47 (cited by the Office Action), discusses editing of an image to add a legend or "graphic and character patterns" which are appended to the upper right of a form (e.g., FIG. 36A/36B) so that the relationships between graphic patterns and colors can be understood. The graphic patterns are added to all the bar graphs in

the illustrated image. Isemura does not disclose or suggest modulating the patterns or modulating the patterns based on a relationship between the color image pixel and a conflicting color.

For at least the foregoing additional reasons, **claims 11-14** are not anticipated and are not obvious in light of Lee and Isemura taken alone or in any combination.

Claims 21-23 were rejected based upon similar rationale as **claims 4-6**, respectively. In this regard, arguments similar to those submitted in support of **claims 4-6** are submitted in support of **claims 21-23**.

Claims 7-9 and **16-18** were rejected under 35 U.S.C. §103(a) as being unpatentable over Lee and Isemura and further in view of Ichikawa.

However, **claims 7-9** depend from **claim 1** and **claims 16-18** depend from **claim 10** and are patentably distinct for at least that reason.

Additionally, **claim 7** recites measuring a color distance between at least one pixel in the image and at least one **conflicting color**. Lee discloses measuring a distance between pixels and peaks. However, the peaks are not classified as conflicting colors and none of the cited references disclose or suggest identifying or classifying conflicting colors.

For at least the foregoing reasons, **claim 7**, as well as **claims 8-9**, which depend therefrom, is not anticipated and is not obvious in light of Lee, Isemura and Ichikawa taken alone or in any combination.

Additionally, even if Ichikawa discloses applying an attenuated spatial modulation to at least one pixel in the single colorant version of the image, it is respectfully submitted that Ichikawa does not disclose or suggest the level of attenuation being a linear function of the measured color distance. It is respectfully submitted that it is unclear exactly what column 3, lines 32-65, of Ichikawa disclose. However, even if the cited portion of column 13 and FIGS. 20A and 20B are meant to disclose some form of attenuation of a reference modulation, it is respectfully submitted that the step discontinuities apparent in FIG. 20B clearly indicate some non-linear function. Therefore, **claim 9**, which recites --the level of attenuation being a linear function of the measured color distance-- is not anticipated and is not obvious in light of Lee, Isemura and Ichikawa taken alone or in any combination.

Alternatively, if the modulation technique of Ichikawa is taken to be linear,

then it is respectfully submitted that Ichikawa does not disclose or suggest the non-linear attenuation recited in **claim 8**, since Ichikawa, if disclosing any form of attenuation at all, can only be construed as disclosing one form of attenuation (e.g., FIG. 20B).

For at least the foregoing additional reason, at least one of **claims 8** and **9** is not anticipated and is not obvious in light of Lee, Isemura and Ichikawa taken alone or in any combination.

Claims 16-18 were rejected on the same basis as **claim 7**. However, each of **claims 16-18** recite aspects related to --conflicting color--.

Additionally, arguments similar to those submitted in support of **claim 7** are submitted in support of **claims 16-18**. Furthermore, **claim 18** recites wherein the relationship between the conflicting color and the color image pixel comprises a color distance within a CIELAB color space. The Office Action does not even assert that the combination of references disclose or suggest a relationship between a conflicting color and a color image pixel comprises a color distance within a CIELAB color space.

For at least the foregoing reason, at least one of **claims 7-9** and **16-18** are not anticipated and are not obvious in light of Lee, Isemura and Ichikawa taken alone or in any combination.

Furthermore, there is no motivation in the art for combining the cited portions of Lee, Isemura and Ichikawa. For example, as indicated above, Isemura was filed after Ichikawa and Hiroyuki Ichikawa is an inventor in both Ichikawa and Isemura, yet the inventors of Isemura did not find it obvious to include the subject matter cited by the Office Action from Ichikawa into the invention of Isemura. Furthermore, Lee did not find it obvious to include the subject matter from Isemura and Ichikawa into the system of Lee.

For at least the foregoing reason, **claims 7-9** and **16-18** are not anticipated and are not obvious in light of Lee, Isemura and Ichikawa taken alone or in any combination.

Telephone Interview

In the interests of advancing this application to issue the Applicant(s) respectfully request that the Examiner telephone the undersigned to discuss the foregoing or any suggestions that the Examiner may have to place the case in condition for allowance.

CONCLUSION

Claims 1-23 remain in the application. For at least the foregoing reasons, the case is in condition for allowance. Accordingly, an early indication of thereof is respectfully requested.

Respectfully submitted,

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